What is claimed is:

1. A method for fabricating a semiconductor device, comprising the steps of:

forming a hafnium vanadium oxide ($HfVO_x$) layer on a substrate structure providing a predetermined semiconductor device structure, the $HfVO_x$ layer being used as a hydrogen diffusion barrier layer; and

forming an insulation layer on the $HfVO_x$ layer.

2. The method as recited in claim 1, wherein the predetermined structure includes a capacitor.

3. The method as recited in claim 1, wherein the $HfVO_x$ layer is deposited through a physical vapor deposition technique.

4. The method as recited in claim 3, wherein the $HfVO_x$ layer is deposited to a thickness ranging from about 200 Å to about 1000 Å.

5. The method as recited in claim 3, wherein the $HfVO_x$ layer is deposited at a temperature ranging from about 100 °C to about 900 °C.

6. The method as recited in claim 1, further comprising the step of performing a rapid thermal annealing process

carrying out at a temperature ranging from about 100 °C to about 650 °C for about 1 to 5 minutes in order to densify a surface of the $HfVO_x$ layer.

7. The method as recited in claim 1, further comprising the step of performing a rapid thermal annealing process at a temperature around 100 °C to about 650 °C for about 1 to 5 minutes in an atmosphere of Ar and O_2 or N_2 and O_2 in order to densify a surface of the $HfVO_x$ layer.

8. The method as recited in claim 1, further comprising the step of ionizing oxygen and accelerating the ionized oxygen with use of an electric field generated around a substrate in order to densify a surface of the $HfVO_x$ layer, wherein the acceleration is proceeded at a temperature of about 100 °C to about 650 °C for about 1 to 5 minutes.

9. The method as recited in claim 1, further comprising the step of ionizing Ar or Ar and Oxygen simultaneously and getting this ionized Ar or Ar and Oxygen to hit the $HfVO_x$ layer in order to densify a surface of the $HfVO_x$ layer, wherein the hitting procedure is proceeded at a temperature of about 100 °C to about 650 °C for about 1 to 5 minutes.

10. The method as recited in claim 1, further comprising the step of ionizing nitrogen or nitrogen and oxygen simultaneously and getting this ionized nitrogen or nitrogen

and oxygen to hit the $HfVO_x$ layer in order to densify a surface of the $HfVO_x$ layer, wherein the hitting procedure is proceeded at a temperature of about 100 °C to about 650 °C for about 1 to 5 minutes.

11. The method as recited in claim 1, further comprising the step of performing a heat treatment with NH_4 or NH_4 plasma to the $HfVO_x$ layer at a temperature of about 100 °C to about 650 °C for about 1 to 5 minutes and then forming a uniform oxide layer with use of oxygen so as to densify a surface of the $HfVO_x$ layer.

12. The method as recited in claim 1, further comprising the step of performing a heat treatment with NH_4 plasma, Oxygen plasma or UV ozone at a temperature of about 100 °C to about 650 °C for about 1 to 5 minutes and then forming a uniform oxide layer with use of oxygen so as to densify a surface of the $HfVO_x$ layer.